Model Development Activities and Experiences Worldwide

An Overview

Dr. Lawrence Jones

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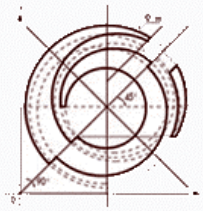

Outline

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- Background
- US Activities
- European Activities
- Key Issues and Challenges

August 15, 2001

ERCOT Wind Generation Stability Model Working Group Kick-Off Meeting

Wind Generator Modeling in
Power Systems Dynamic Simulation- European Experiences

Dr. Lawrence Jones

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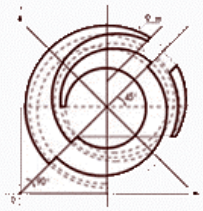

Conclusions

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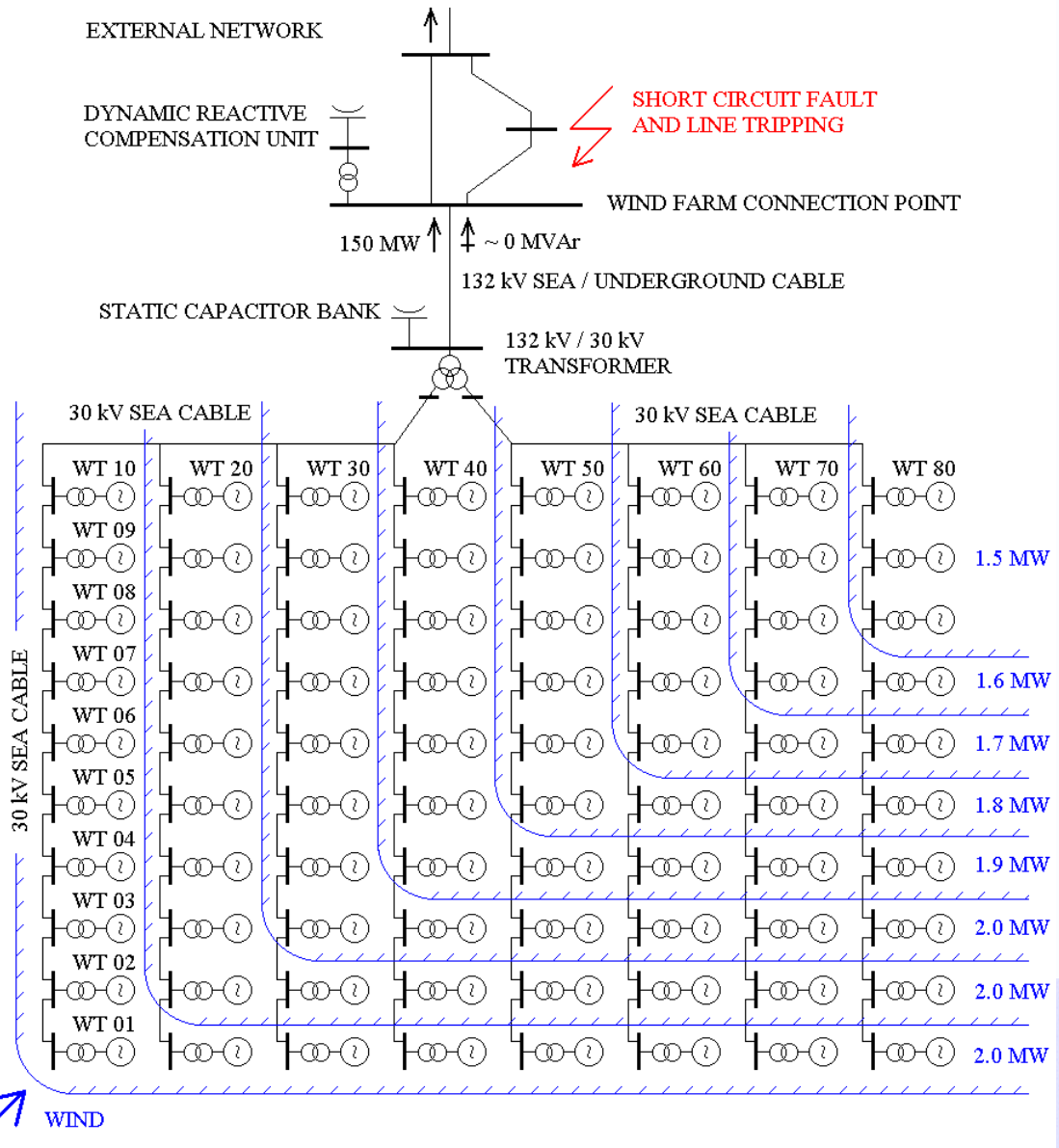
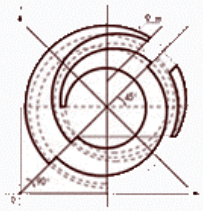
Can we develop an aggregated model of a large wind farm?

YES

Example of a large offshore wind farm with 80 wind turbines





US Modeling Activities

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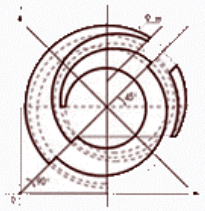
- Utilities,RTO/ISO
  - ERCOT, PacifiCorp, WAPA, SCE
- Universities and Research Institutes
  - Montana Tech, NREL, PNNL, University of Massachusetts-Amherst
- Vendors, Consultants
  - PTI,Elektrotek, GE Power Systems



European Modeling Activities

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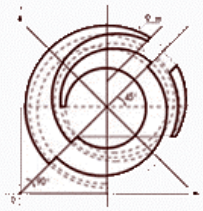
- Denmark
  - Utilities
    - ELTRA, NESA AS
  - Universities and Research Institute
    - Technical University of Denmark, RISO National Laboratory, Aalborg University
  - Vendors, Consultants
    - Techwise
- Spain
  - Universidad Carlos, Madrid



European Modeling Activities

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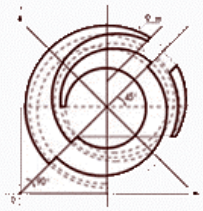
- Sweden
  - Chalmers University of Technology
  - Royal Institute of Technology
    - International Workshop on Transmission Networks for Offshore Wind Farms
- UK
  - University - Research
    - UMIST
  - Vendor and Consultants
    - ERA Technology LTD, Garrad Hassan



European Modeling Activities

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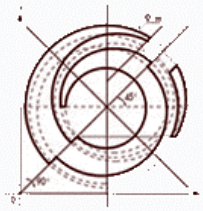
- Netherlands
  - Technical University of Delft
- Northern Ireland
  - Northern Ireland Electricity PLC
- Norway
  - SINTEF
  - IEEE/CIGRE Wind Workshop June 2002



Key Issues

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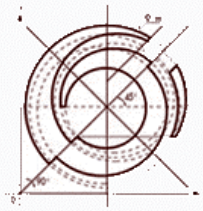
- Wind Turbines
  - Different Turbine Technologies
- Variation in Geographic, Aerodynamic and Operational Conditions
- Wind Plant Model
  - Equivalencing / Aggregation Methodology
  - Impacts of Collector System
  - Preservation of Mechanical Natural Frequencies
  - Preservation of System Dynamic Properties



Challenges

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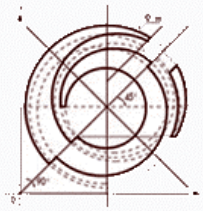
- Modeling Approaches and Process
  - Turbines
  - Plants
  - Assumptions
  - Unsymmetrical Conditions
- Automation of Modeling Process
  - Flexibility and Transparency
- Operational Models
  - State Estimation
- Interaction with Bulk-Power and Markets
  - Simulation



Conclusions

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YES

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